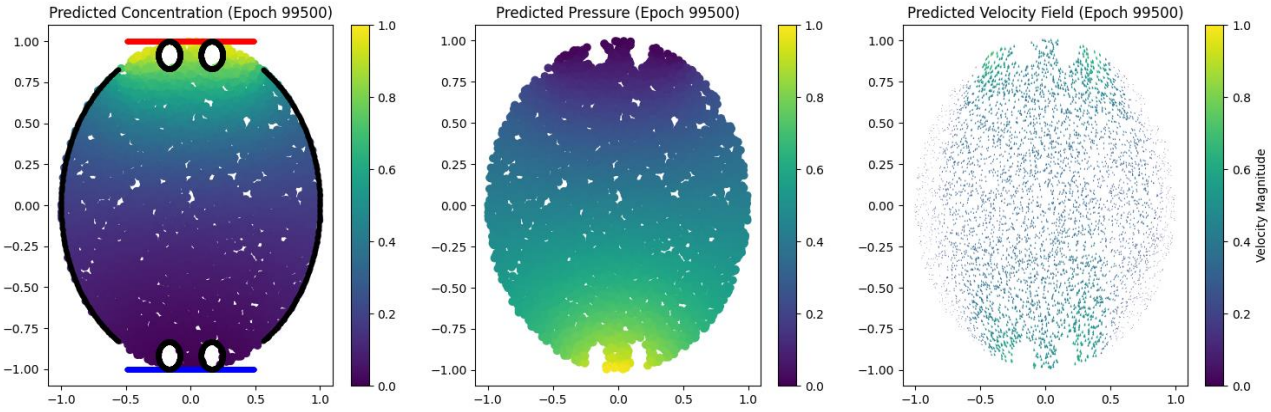
Masterthesis!

Developing a physical-informed neural network for solving the inverse convection-diffusion problem



As part of the FlowForLife research project, a microfluidic supply network for 3D cell clusters is being developed. One aspect of the network design is the oxygen transport in the surrounding matrix. To characterize this, oxygen quenching luminescent particles are added to the surrounding matrix. The oxygen concentration can be determined at each particle.

From these sparse pointwise concentration data, the flow field in the porous surrounding matrix is to be determined. A solution of the convection-diffusion equation representing the measured concentration field must be found so that conservation of mass and momentum is satisfied in the underlying flow field. Physically-informed neural networks (PINNs) are a promising approach to find such a solution. In this thesis a PINN code should be developed and the achievable accuracy is to be evaluated. The following tasks could be part of the thesis:

- Creation of synthetic data sets
- Development of the PINN
- Benchmarking and investigation of various influencing factors such as measurement accuracy, data density or knowledge of boundary conditions on the prediction accuracy
- Reference experiments if necessary.

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